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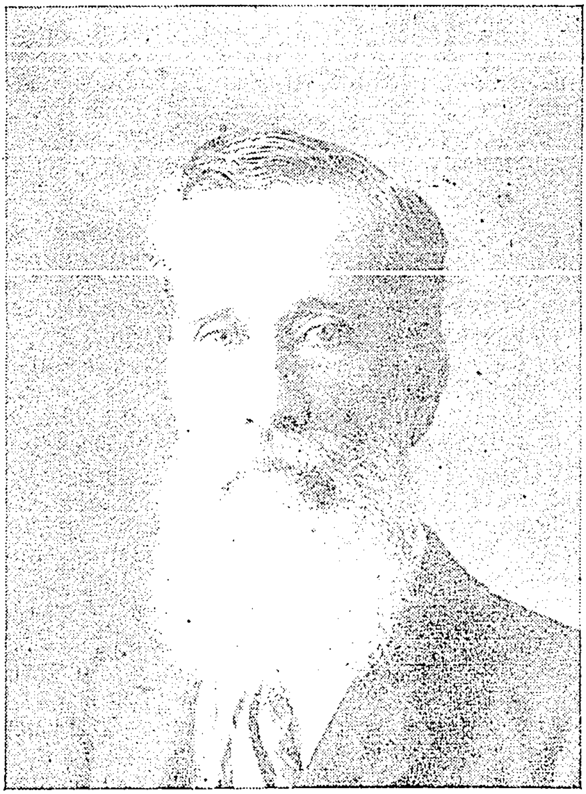

J. B. ATHERTON.

President of the Hawaiian Sugar Planters' Association.

1898.

New York Sugar Market.—Latest quotations—Raw sugars firm at 3½, with buyers taking all stock offered. Receipts liberal. Shipment of the Cuba crop is going on as rapidly as it is possible to put the sugar on board. The market is governed just now by the amount of receipts which, for the week, increased some 9,000 tons, the increase being from Cuba, and, as a result, the market has not strengthened, but has maintained fairly well, for the reason that the sugars arriving and offered for sale have been in small amounts and taken up by the refiners. Java sugars are offered moderately at 8s. 1½d., equal to 3½c. duty paid for 96° test; but little, if any, business has been done with refiners.

On the present basis of cost, sugar refiners are growing rich beyond the dreams of avarice. No industry can be very profitable without inviting fresh competition. Sugar refining is a bonanza at one-sixteenth of a cent per pound net profit. Today refiners are getting one quarter of a cent net profit, or 80 cents per barrel. If the output is 45,000 barrels per day, there is a net daily profit of $36,000, or nearly $250,000 per week.—Ex.

With the bounty conference ratified, the only important sugar question remaining unfinished is the Cuban, and until this is settled, and in what way, it is impossible to say whether the next production in the island will show any great increase over this year's crop. At present, absolutely no inducement to extend operations exists, and a general diminution in the production of cane sugar throughout the world will perhaps be seen next season, unless prices improve in the meantime. The requirements of the American refiners at the present time continue very moderate, and their weekly receipts show an almost entire absence of movement of Beet from Europe, while their stocks show a further considerable reduction.—Ex.

The Governor of Hawaii has notified the Interior Department at Washington that he will appoint one or more experienced coffee growers or dealers as delegates to the International American Congress, for the study of the production and consumption of coffee.

The first delegate accredited to the conference to study the production and consumption of coffee, which was arranged for the recent Pan-American Congress in the City of Mexico, is Senor Jose Godoy, charge d-affaires of Mexico in Washington. The State Department has been notified of his appointment. The conference will be held in New York in October.

It is reported that influential agents of England and Germany have been to Havana for the purpose of quietly bringing powerful pressure to bear on the leaders of the Cuban Congress to enact laws that are designed to give one or the other of those countries a monopoly of the carrying trade of Cuba. It is admitted in Washington that if such laws should be enacted, the United States would be shut out from the commerce of Cuba, and that, of course, Europe's control of Cuba's trade would be made perfect and permanent. Senator Platt, of Connecticut, chairman of the committee on relations with Cuba, and author of the amendment which bears his name, does not believe there is any serious intention at Havana to do anything calculated to embarrass the relations between Cuba and the United States.—Sugar Journal.

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CONCERNING COFFEE.

An international convention will be held in New York during November for the study of the production and consumption of coffee. At present, little is known of the best varieties as regards quality and methods of cultivation, the most profitable for different markets, amount of consumption and any other information that may tend to improve its use and quality. Hawaiian coffee, when care is taken in its cultivation, harvesting, drying and packing processes is not surpassed by any produced in other countries. Age adds greatly to the value of choice coffee. The pioneers in Hawaii had a practice of drying the berries in the sun for weeks, then bagging and storing for months drying in a loft. Those who can remember drinking genuine old Kona coffee, will never forget the delicious aroma that filled the room when it was poured out at the breakfast table, reminding of the fabled "nectar of the gods." Customs change, however, with the passing years, and much of the coffee drank now-a-days is imported from the "faraway." A coffee plantation in Kona, Hawaii, well kept and with its crops well dried and aged, will pay as well now as in years past, if the coffee planters take care to have none but the best sent to market. Genuine Kona coffee is as good today as it ever was, but the older it is, the better its quality. In the American market, the principal coffees are the Rio, Maracaibo and Java. Pure old Kona, when genuine, is better than any of them.

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THE VOLCANO OF KILAUEA.

The recently renewed activity of volcanoes, in different parts of the globe, has attracted universal attention, but there does not seem to have been any close connection between our own Kilauea and other distant volcanoes, where great activity has been noted. The nearest volcano to our two is more than 3,000 miles distant. Kilauea is a model—made to be viewed and "personally inspected." It is one of the very few that can be approached when in full action to the crater's edge, and even stirred with a long pole, while in violent activity, without harm to the visitor. Located some forty miles from the lofty crater of Mauna Loa, which is occasionally in action, the two seem to be entirely disconnected, the activity of the one having generally little or no effect on the other. Mauna Loa is a summit crater, thirteen thousand feet above sea level, while Kilauea is about four thousand feet above the sea, and of comparatively easy access from Hilo, by stage coach or horseback. It is a pit of large dimensions, circular in shape, with perpendicular walls, varying from two hundred to one thousand feet in height. Fifty years ago, the floor of this crater was several hundred feet below what it now is, recent overflows of lava having raised the floor to its present level. From any part of the high surrounding wall a distant view of the lava lake can be had, but a descent into it affords the best and the most impressive realization of its immensity and grandeur. This descent may be made either on foot or horseback, and in either case should be accompanied with guide. Travelers may approach to the edge of the boiling cauldron, and even secure specimens of the lava thrown from it. There may be other volcanoes that may be approached as near, when not in action, but none with more safety and satisfaction to the visitor than this—the only Kilauea—where no fatal accident has been recorded during the past hundred years, or where the visitor feels better repaid. It has been well termed—the tourist's opportunity of a lifetime—THE VIEWING OF A LIVE VOLCANO WITH PLEASURABLE SATISFACTION.

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A NEW CATTLE FOOD.

Experiments have been made in the British West Indies, which will result in the formation of a profitable industry in the manufacture of a new cattle food, to which the name "molascuit" has been applied. It is a composition of molasses and cush-cush of bagasse, the finest part of the fiber of sugar cane. Fifty per cent of cush-cush is digestible and nutritious. The proportions of the composition are 80 to 85 per cent of molasses and 15 to 20 per cent of cush-cush. This composition is air dried and may be made by utilizing the gases from the factory furnace. When ready for the market, it presents the appearance of very finely ground oil cake. There is another preparation in use known as "molassine meal," made from beet-sugar molasses and a vegetable matter, which sells at about $32 per ton and has a very good demand. Molascuit can be sold at about 20 per cent less, and can be shipped in bags. As a by-product of sugar it might be of considerable value to planters, who would thus have two ways of disposing of molasses—in making rum and molascuit. The matter has been brought before the board of agriculture, with a view of getting the preparation officially recognized, so that uniformity may be obtained. I have inquired of sugar planters if they could afford to use bagasse for this purpose, in preference to utilizing it for fuel, and was told that only a very small portion—and that the finest part of the fiber—of bagasse was required in the preparation, and that it would not interfere to any extent with the use of bagasse as fuel. They also acknowledged its value as a food for cattle and as a new industry for the colonies.—U. S. Consular Reports.

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CONCERNING IRRIGATION IN HAWAII.

Honolulu, September 1st, 1902.

Editor Planters' Monthly—Dear Sir:—I have read Mr. J. T. Crawley's article in your last month's issue regarding excessive irrigation, etc., etc., with much interest and must say that Mr. Crawley deserves much credit for his diligent research in the interest of our planters. At the same time I cannot forbear to state that I differ with Mr. Crawley in many respects and will try to disprove some of his assertions. In the first place the particular conditions described in the article referred to, do not and cannot apply to all Hawaiian soils, in fact not to a great many of them. That porous subsoil is by no means found as frequently on these islands as Mr. Crawley tries to make out, on the contrary one very often meets with a solid bedrock at a depth of from 2 to 4 feet from the surface and occasionally layers of hard pan of clay are found, both of which are nearly impenetrable by water. Furthermore, the permeability of most Hawaiian soils is not so very high, especially is this the case with the heavier clay soils. These latter soils are of close texture and unless they have been recently plowed, contain but few non-capillary spaces, therefore offer great resistance to the downward movement of water. It is a well known fact that on many sugar plantations high walls are erected of earth only, which are destined to act as ditches to convey the irrigation water from one elevated place of the field to another, and a careful observer will have noticed that in most cases little if any of the water leaks through the walls of these ditches, much less is there any great loss through percolation. Is not this a palpable argument against Mr. Crawley's mistaken assertions?

As to the accumulation of salt in our soils I wish to say that were it not for the occasional heavy rains in the winter with surface drainage, there would soon be a perceptible increase of salt in many of our soils, in spite of a frequent excessive irrigation.

From what I have seen of Hawaiian soils I am led to believe that in most places the capillarity of our heavy clay soils is a very good one and therefore constantly regulates the supply of water in the surface soils. As soon as evaporation takes place after irrigation, not only is there a decrease of the moisture content in the surface soil, but there is also a decrease of the subsoil water by translocation or surface-tension, caused by capillarity.

The loss of nitrate of soda is therefore not as heavy as it might appear from Mr. Crawley's remarks, for as he says: "It goes wherever the water goes," hence if the subsoil water rises again to the surface it carries the nitrate with it. Only where the subsoil is very porous the danger of loss of this fertilizer is apparent. The application of nitrate of soda should never be followed by a heavy irrigation; on the contrary the fertilizing should take place after irrigation. The loss through a heavy rainfall is quite accidental and cannot be controlled. Plantations situated in districts with much rainfall should use nitrate of soda sparingly anyhow.

H. C.

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SENATOR THURSTON ON HAWAII.

[The recent arrival here of several prominent congressmen is to look into the condition of affairs in Hawaii, with a view to act intelligently when called to vote appropriations from the national treasury for its benefit. Congress acts through committees, and the recommendâtions of the committee are generally adopted. Senator Thurston is an ex-member of Congress, and during his stay in Honolulu addressed a large audience on the relation of Hawaii to the United States, and the duty of Hawaiian citizens under the change. It was an exceedingly eloquent address, which we should like to publish in full, but must be content with a few paragraphs taken from it:]

I have no apologies to make for being on your platform here tonight. You and I are citizens of the great Republic to whose destinies we are all thoroughly committed. In its progress and in its civilization and its advancement, its triumphs and achievements, whatever glory it gives to us on the mainland, whatever glory is possible to you in these islands of the Pacific sea, will come through the mission of the great Republic. We are all citizens of a common country, and I have no doubt that although you have only recently become a part of our body politic, that you will grow to love and honor the flag of the Republic as much as those who have lived under it since their birth. To me, fellow citizens, it is a flag for which no man has yet been called upon to apologize. Wherever it floats, on land or sea, it floats for the liberties and equalities of all mankind. There is not a star in its azure shield that has ever yet been dimmed by an act of national dishonor. There is not a glorious stripe in all its folds that has not stood and gleamed for the elevation of the human race.

Progressive men and progressive nations never look backward. The conquerors of the world have ever kept their faces to the sun, and today if you are to achieve what you may in the destiny of these islands, it is well that you should turn your backs on the past, accept the situation in which you find yourselves, and unite with the liberty-loving people of the United States to make our common destiny a glorious and a grand one.

My fellow citizens, when a new part of the world is taken in under the fostering care of a great power, it necessarily takes a long time for the people on both sides to understand each other. It will necessarily take a long time and the progress will be slow whereby we can enact for you all the legislation that your peculiar position and necessities may demand. Therefore, the responsibility is upon you to let the American people know in some dignified and proper manner just what you need and what we ought to enact in the way of needed legislation.

I have not come here tonight to discuss for a single moment your local political conditions. I presume I do not understand them, and I would not attempt to interfere in regard to them if I did; but I think I can tell you tonight some of the ways in which your necessities and demands may be properly brought to the attention of the administration and of the Congress of the United States—may be brought to their attention in such a way that what you justly ask will be granted to you without unreasonable delay. To achieve something in the United States in the way of your material advancement, you cannot expect to receive a proper hearing or to secure adequate legislation unless your needs and necessities and demands are brought to the attention of one of the two great political parties of the United States.

In the United States there are but two great political parties. Either one or the other of these parties for three-quarters of a century has held the destinies of the United States in its grasp. What has been accomplished has been through the instrumentality of these great parties.

You might as well send a frog to chipper at the doors of the Court of St. James for what you want as to send to Washington a delegate who is not one of or in harmony with either of the two great political parties. (Tremendous applause.) This is not a political theory—it is a political fact.

We never had any islands until we got yours. We did not know much about the way to run a country so far away from the mainland, but now, as Steve Elkins says, "We've got islands to burn." I hope we won't burn your islands, and I hope your volcanoes won't. (Laughter.)

Today you are most important to the United States, because you are the outpost of our Pacific sea commerce. You are most valuable to us, because you stand here, as I might say, the gateway to the Orient. I don't believe you fully understand it. I don't believe that we on the mainland yet know how important a feature in the increasing and expanding commerce will become the islands of Hawaii and the city of Honolulu.

There is one thought to be borne in mind. We cannot make these islands as important as we would; we cannot do for you all that your conditions may require, without your energetic co-operation and assistance; and do you know, my fellow citizens, that legislation in the Congress of the United States comes only in one way? The party in power fashions and shapes and enacts every important law in the Congress.

You can send men from these islands to represent you there and they may be never so good and great, I care not what he may be, or how energetic their efforts, unless you send a man or men who are in harmony with the Republican party in both branches of Congress, and with the Republican President of the United States, he will accomplish little. (Prolonged applause.)

I do not care who you send to Congress, and least of all do I care what you do with your local legislature, so that you work out the best interests and demands of your own citizenship. But I do advise you with all my strength that if you wish to secure results from the Republican administration to send some man there who will come with a certificate of election from the Republican party of the Hawaiian Islands. (Prolonged applause.)

It is the purpose of the American people, through the Republican party, and in the near future, not reckoned by years but by months only, to expend in these islands millions and millions of dollars in the improvement of your harbors and the erection of the naval station at Pearl Harbor. Other improvements will come along in due course.

The United States government ought not to have taken away the revenues of your ports (tremendous and prolonged applause) without giving you something adequate in return. (Applause.) It should not have depleted your revenues unless it gave you something of equal value from which you could derive revenue to carry on your local affairs. I think it is only necessary to have that question brought to Congress and the proper appeal made through the proper representative to have this matter straightened out, and this imposition will cease. (Applause.)

Our government has taken Hawaii into her arms as a tender mother takes the tired child, not to wrong or to injure, but to give the help of the mother, and whatever appeal comes to the American people through the Republican party will come to the ears of a gentle mother, attuned to good will toward mankind, attuned to the obliteration of race prejudice, and as the mother deals with her child, so will the great Republican party deal with you, because she hopes and expects that you will realize her highest aspirations for you. She hopes the time is coming, and coming at a no distant day, when you will no longer be a Territory, when with your glad consent we will place the Hawaiian star in the galaxy of the stars of the other States.

My fellow citizens, it has given me great pleasure to be with you here tonight. Proud of my country as I am, and of the many generations of my forefathers who have moved in it, proud as I am of the great powers that are joined together for the uplifting of mankind; proud as I am of what is coming to our country, I am proud indeed that such people as have gathered here tonight have come into the citizenship of the great Republic. I am glad to welcome you to American citizenship. It is the only title to nobility we have to confer. But such as we have, it is the badge of the highest order, the declaration of American citizenship, and we lay it at your feet and ask you to put it on and wear it for the glorification of our common country. (Applause.)

We are working out the mighty problems of human destiny. I have no doubt that a power over and above us all guides us as men and nations. I have no doubt through the struggles of war and peace, mankind is moving toward a grander history than the world has ever known.

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FLORIDA PINEAPPLES, ORANGES, MANGOES, ETC.

A Report on the Cultivation of Pineapples and Other Products of Florida by Robert Thomson, Formerly Superintendent of the Botanic Gardens of the Government of Jamaica.

ORANGES.—I visited according to arrangements made at Washington a great Orange nursery at Glen. St. Mary, about 30 miles from Jacksonville. Many millions of plants have been propagated here. There are here about half a million plants comprising all the best varieties of Citrus fruits. The proprietor is a well known expert. Orange cultivation prior to the great freeze of 1895, was the greatest industry of Florida, it was the chief "wealth producer," extending over an immense area to the south of Jacksonville. Previous to that great disaster that ruined thousands of families, this region was extolled as the most congenial in Florida for oranges, for it is recognized by most leading growers that the further north, even to "danger point," they grow the more luscious is the fruit. This tallies with our cultivation on the hills. Another frost two years ago destroyed the groves connected with this nursery, the trees being frozen to the ground. Thousands of groves were also destroyed by that morning's frost over hundreds of miles of land. Many of the growers are now planting further south in order to escape the frosts. Since last frozen the trees have sprung anew from the bases of the trunks and they now present a splendid appearance having attained a height of seven or eight feet. Several stems are allowed to grow from the base,—most luxuriant stems, branches and foliage. Next year innumerable trees are expected to yield considerable crops. Only a few severe freezes have occurred in about 60 years.

In this extensive nursery thousands of small plants budded two years ago yield from 20 to 40 fruits each. I suggested that many hundreds of small trees could be grown to the acre for early cropping. These precocious trees are budder on citrus trifoliate stock. Pears, peaches and plums are commonly cultivated side by side with the orange. Many of the groves in the great orange region of Orlando that were less severely injured by frost are now in a flourishing condition, far finer trees than any in Jamaica. This is another example of the capability of a sandy soil, in which they are made to flourish by constant care and fertilizers. At this nursery I witnessed a new departure in orange cultivation. A considerable number of plants are under experimental treatment for the Department of Agriculture at Washington, plants that were hybridized a few years ago. There are at least fifty very distinct forms, distiinguishable by foliage, etc. These are about eight feet high, and some of them are likely to fruit next year for the first time. At Maimi a few hundred miles further south I also saw duplicates of these new forms at the Government Experiment Station, but much smaller plants. Varieties that will endure more frost as well as superior in point of quality are anticipated from these hybridized types. In the orange plantation connected with this nursery my attention was directed to great piles of logs between some of the wide rows of trees. I was surprised to learn that these piles are placed in summer in readiness for the winter frost. When the temperature falls seriously the huge piles of wood are set on fire to repel the frost by means of smoke, this in the open air. The result is usually satisfactory. Orange groves I noted everywhere are peculiarly sensitive to bad cultivation, that is by allowing weeds to grow and by withholding fertilizers, by insufficient cultivation. Whenever neglected, they languish. The ownership of a ten-acre grove has been and is still looked forward to as ample to provide all the comforts of a well-to-do family. Each tree is highly prized, for on arriving at maturity it is valued at from $15 to $25. "In an orange grove 8 to 10 years old $1,000 per acre has often been realized." Ordinary manure is deprecated "the benefits of barn manure in an average grove are in serious question. The fruits produced by nitrogen from this source are as above stated usually large, coarse, thick skinned, with abundant rag and of inferior flavor." My attention was repeatedly called to the notorious manner in which oranges are packed in Jamaica. Frequently trained packers have been selected in Orlando, sent a few days journey to New York or Baltimore at great expense and besides paid $2 a day to rehandle orange shipments from Jamaica, that is to size, pick and repack in boxes for distribution. Orange growers and dealers freely express their surprise at this incredible example of Jamaican incompetency. For be it remembered that the splendid quality of the fruit itself is depreciated. "Fruit which is well known by a brand will often sell readily and quickly for 50 per cent more than other fruit equally as good, but not known to be so by the buyer." Orange and grape fruit groves are being largely planted in the vicinity of Maimi. Plants three years old budded on small lemon stock yield 100 fruit. The size and luxuriance of the foliage is remarkable. Several of the most successful growers informed me that they did not know 10 years ago the difference between an oak and an orange tree. With determined energy and enthusiasm they hav become noted cultivators. Before the 1895 freeze five million crates of oranges were shipped from Florida valued at about fifteen millions of dollars. After this freeze the number of crates fell to 100,000. Last year it increased to 750,000 and next season double the latter number are expected. California produces six million crates. In a conservatory at Washington the most famous of all orange trees was pointed out to me, the original plant of the navel variety from which by propagation about half of the orange crop of California has originated. Californians commonly salute this wonderful tree.

Since my return from Florida I have visited the parish of Manchester the chief centre of orange production in Jamaica, more than half of all that are shipped coming from here. One firm alone collects and ships about 100,000 barrels a year. Great benefit has accrued to Jamaica by the naturalization of plants introduced hundreds of years ago. Thus Logwood and oranges have spontaneously overrun hundreds of miles of the island and the former has long been established as one of the staple products. The spontaneous diffusion of a species of plant affords abundant proof of the eligibility of the environments in which it grows. Innumerable orange trees are thus widely disseminated in Manchester. Intermingled with other forest trees they have been subjected to severe condition of existence. Thus they present a dwarf stunted aspect. Practically the only attempt at cultivation has been to destroy the native trees by which they are surrounded with the result that small crops are obtainable. From these semi-wild trees thus reclaimed from the forest the average yield is less than half a barrel each. A little attention is sometimes bestowed upon groups of trees. For instance, trees occur on the settlers' coffee fields which have to be regularly weeded. Here they occasionally yield several barrels each and they present a distinctly improved appearance. One of the settlers pointed out a considerable group of trees he obtained on land he purchased. A few years ago his first crop was sold for 3c, the following year he had 6 barrels and in the two subsequent years 14 and 62 barrels respectively. The trees are very unequally distributed; in many places from 20 to 60 may be counted on an acre—occupying but a small portion thereof. Commonly from 6 to 12 of these dwarf trees are crowded in a space equal to that allotted to a single tree in Florida. The Manchester oranges are excellent in point of quality. They are sold at 2s. per barrel of about 400 fruits. If they were carefully handled, sized, etc., and packed in boxes the value would be greatly enhanced. It is interesting to note that several gentlemen in this parish are initiating the cultivation of budded trees with very promising results. I strongly recommend medium sized wild trees as the best stock for budding purposes. This can be done on a large scale. The cultivation of coffee in Manchester is a large industry among the small settlers. The profit realizable can hardly exceed £2 per acre. If the same cultural attention were paid to the cultivation of oranges the returns would be surprising. Instead of an acre, containing irregular groups of desolate orange trees aggregating some 30 to 60, from which 20 barrels may be obtained, 150 of these small trees could be established per acre by the simple process of transplantation. By higher cultivation than that applied to coffee 300 barrels of oranges would be assured per acre. On the lines I have propounded orange cultivation is capable of becoming one of the great industries of the island. There are numerous decayed or worn out trees that should be destroyed and replaced by healthy medium-sized trees. Better to cut the transplanted trees well back to induce new and vigorous growth. In the delightful climate of the Port Royal mountains this tree yields the very best possible fruit. Thousands of acres could be cultivated in lieu of thousands of trees as at present. The moderate application of fertilizers would ensure splendid returns when the soil is not sufficiently rich, this applies to all parts of the island. All the conditions referred to emphasize our pre-eminent orange growing capabilities, capabilities such as throw into the shade all Florida that culminated with returns valued at fifteen million dollars. Our illimitable resources await enterprising Englishmen to embark in orange growing. Limes grow with perfect success, double the size of those that grow on the keys of Florida. On rocky land hundreds of thousands of lime trees could be established at a trifling cost.

MANGOES.—Palm Beach is perhaps the most famous winter resort in the world. At one of Mr. Flagler's hotels 400 rooms are added annually. The tropical aspect of the grounds is extremely grand; great avenues of palms, miles in length and forests of palms. The cocoanut plays an important part; thousands of them commonly 30 feet high are transplanted to command effect. Many other tropical plants are displayed here. There are also hundreds of acres of pineapples and the shed system is strongly advocated. One of the finest plantations is that of Mr. Mattham, and he has several hybrid forms from Washington. Mango and Avocado trees abound here; mango fruit is extremely popular; hundreds of thousands are eagerly bought at about $7 per thousand. In the city of Key West the consumption is very large and its popularity is extending northwards, where in the near future it will doubtless become a staple fruit. My programme from Washington included a visit to a noted mango grower, Professor Gale. He was delighted to show what he has done. Great Indian grafted trees as well as our No. 11 variety are propagated far more successfully than is the case in the West Indies,—by budding, grafting, and inarching. It affords me great pleasure to report that I obtained from the Director of Botanical Gardens at Washington six plants of a new variety of banana; it is described amongst bananas as "the best fruit of any." My attention will be directed to its propagation with the least possible delay.

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SUGAR INDUSTRY IN BAHIA, S. AM.

Like other states in Brazil where the raising of cane and the manufacture of sugar in Bahia constitutes a considerable industry, the state of Bahia, with its numerous factories, is experiencing its share of the loss suffered by the industry this year. The depression commenced about two years ago, but as the profits were then sufficient little was thought of the future, and when the final drop in price came this season both the grower and manufacturer were as surprised as if it had not been foreshadowed.

The principal sugar-cane region in this state is within a radius of 30 miles from Bahia and is located chiefly upon the tide-water rivers which flow into Bahia Bay. The factories are usually considered as forming three groups, consisting of eighteen vacuum-pan plants, capable of producing Demerara, white and yellow crystals, and numerous small ones with trains of open kettles capable of making only crude sugar, muscovado, wet or dry.

The sugar season in this district is from October to April, but is extended over a greater period if rain does not interfere with transportation. This year, there is still enough cane in most sections to last at least a month longer, but, judging from the rainfall the present week, the rainy season has already set in and operations will soon have to be brought to a close.

Some of the large factories rely entirely upon the purchase of cane from near-by planters, though most of them plant for themselves. When cane is bought, it is upon a sliding basis varying with the price of sugar at Bahia, and in the following manner: When white sugar is worth 200 reis (4.8 cents) per kilogram (2.2 pounds), the price of cane is 5 milreis ($1.20) per ton, and for every 10 reis (0.24 cent), up or down, in the price of sugar there is a difference of 300 reis (7.2 cents) in the price of cane. This price was fixed after the month of November of the present season, but some factories pay a slight amount more or less.—U. S. Consular Reports.

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DR. MAXWELL'S ADVICE.

(Queensland Sugar Journal.)

There is undoubtedly still a strong feeling amongst many of our sugar producers that Dr. Maxwell, the Director of Sugar Experiment Stations, has not revolutionized the Queensland sugar industry as he was expected to do, while there is also an opinion in many quarters that he has spent too much of his time in Melbourne. Now seeing that the sugar producers are specially taxed to maintain in part the sugar experiment stations, and the staff connected therewith, this last complaint has on its face a certain amount of plausibility. It remains, however, for the more thoughtful amongst sugar producers to grasp in full what Dr. Maxwell's work in Melbourne has been. It is true he has been assisting the Federal Government with his advice and keen insight into our affairs, but it is difficult to appreciate at their full value what one may call negative results. To those who have watched the progress of Federal legislation and administration in connection with our industry, it must be abundantly clear that there was ample opportunity for the Federal Government to make many mistakes, and indeed a correspondent quite recently set forth his views as to the manner in which the rebate should be paid, proving amply that he himself did not at all grasp all the essentials of a very difficult piece of work. Happily Dr. Maxwell has secured for the sugar producers a very much larger share of the excise than they were originally expected to get, and this, not because he has squeezed more money out of the Federal Government, but because he has been enabled to point out a method of administering the Act, which would be the least costly and the most simple. But if we turn from this work, which has been of undoubted value to our industry, and glance at other matters with which Dr. Maxwell has been connected we find that, despite the calls made upon his time in Melbourne, he has very materially advanced the interests of the sugar producers. He appears to have fairly established the fact of the existence of a considerable area of underground water not only in the Mackay but also in the Bundaberg districts. Indeed to this fact mainly we believe we can attribute a very considerable investment recently in a large sugar property by experienced Queensland growers and manufacturers. Then again he travelled to the Isis, where he happily was in time to prevent the sugar growers expending very considerable sums in a scheme for irrigation, which was bound to have resulted in loss, for the simple reason that in actual practice the water supply would have been found insufficient. It says much for the Director of the Sugar Experiment Stations that he was prepared to cause disappointment, and for a time to delay the initiation of irrigation in one locality at least, sooner than advise farmers to put their money into a scheme which might in a few years, possibly after Dr. Maxwell himself had left the country, fail them at the critical moment. It is the advice of such men that the farmers in Queensland, and indeed in all Australia, badly want from time to time. It needs only a little thought on the part of those interested to recall several other cases in which advice has been given, but we venture to say that almost an equal number of cases can be recalled where the advice has not been followed.

We cannot repeat too often that Dr. Maxwell's work to be of value is in the main advisory, but that advice must be followed by those interested. The Director of Experiment Stations cannot be expected to take the plow from the farmer's hands and do the work for him, nor can he be looked upon as the source of a sort of inspired information, which will teach the farmer a royal road to successful cane cultivation. An advisory head is an advisory head, and his usefulness is limited by two factors: the one the value of his advice, and the other the extent to which his advice is followed. There is little question that Dr. Maxwell is repeating his Hawaiian experiences here. When he first went to the islands there was much scepticism, and a good deal of disinclination to follow his advice. Even when he left there was a small school which absolutely declined to accept him as an authority, though they could not deny the excellent results which had accompanied the efforts of those who worked along the lines laid down by the Doctor. Similar progress will we hope be made in Queensland, but it bears repeating that the progress will follow upon complete confidence between the Director of Experiment Stations and the producers, and only upon the establishment of such a feeling. We note with satisfaction the gradual growth of this confidence, and do not doubt that had we access to Dr. Maxwell's private papers we should find that already he is being consulted by the more thoughtful producers to a far greater extent than is ordinarily supposed. This is the right sort of feeling, and one that makes for progress all round. Such progress also means prosperity, and our sugar industry can well appreciate a change of that sort.

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FRENCH VIEW OF THE BRUSSELS CONFERENCE.

M. Seblime, the able sugar expert who represented France at the Brussels Conference of 1898, has made, for the information of senators and deputies, an interesting statement of the consequences of the Sugar Convention and the position of the French sugar industry after September, 1903.

The French Chambers, he declares, cannot refuse to ratify the Convention, because France would then be shut out, not only from the markets of India and the United States, but also from the great consuming markets of the United Kingdom.

France produces 1,040,000 tons of sugar, and her colonies 100,000 tons, while she only consumes 400,000 tons. Consequently there are 700,000 tons which have to be exported. M. Seblime has slightly overstated this figure because the production of 1,040,000 tons includes the imaginary sugar contained in the molasses, which the manufacturers are allowed to count as part of their legal yield. The actual production of sugar is only 995,000 tons, so that 655,000 tons is the correct quantity of sugar to be exported.

M. Seblime proceeds to consider how the great consuming countries, England and the United States, will stand as customers for the surplus production of the European beet crop. That surplus he states as follows:

	Tons.
Germany	1,500,000
Austria	700,000
France and colonies	700,000
Belgium and Holland	400,000
Total	3,300,000

This is the quantity of beetroot sugar, apart from Russia which has to find a market outside the country of production.

The two great consuming countries swallow 4,000,000 tons of sugar per annum; the United Kingdom taking 1,600,000 tons, and the United States 2,400,000 tons.

The United States is suppliedwith 440,000 tons of home grown sugar, free of duty, namely:

	Tons.
Cane (Louisiana)	285,000
Sorghum (Texas)	7,150
Maple	5,000
Sugar from Molasses	17,977
Beetroot	124,859
Total	439,986

Secondly, it is supplied with 423,000 tons of sugar free of duty, coming from countries outside the Union, namely:

	Tons.
Hawaii	310,000
Porto Rico	100,000
St. Croix (prospective)	13,000
Total	423,000

Thirdly, it is, or will shortly be, supplied with 945,000 tons of sugar at a reduced rate of duty, namely:

	Tons.
The Philippines (25 per cent reduction).	70,000
Cuba (prospective reduction 25 per cent)	875,000
Total	945,000

Therefore the United States now receives sugar free, or partially free, of duty to the amount of 1,800,000, namely:

	Tons.
United States	440,000
Annexed countries	423,000
Total exempt from duty	863,000
Partially exempt	945,000
Total	1,808,000

This leaves 564,000 tons to be supplied from other quarters, paying full duty, and any countervailing duty which may be incurred.

It is clear that this small balance of the 2,400,000 tons consumed in the United States will soon be supplied by the increased production of sugar free, or partially free, of duty.

Not only will the American market be closed to the European surplus, but the United Kingdom will be supplied with sugars from Java, British West Indies, and other cane producing countries, which at present go to supply a portion of the 564,000 tons now imported by the United States. Thus, a quarter or a third of the British imports will, before long, come from supplies diverted from American markets.

M. Seblime naturally regards this prospect as one involving an intense crisis in the European sugar industry. What is to become of its 3,300,000 tons of surplus production?

Clearly, the only remedy apart from reduction is increased consumption, and therefore M. Seblime concludes that the only way to save the French sugar industry from destruction is such a reduction of duty as will speedily double the consumption. The French duty should—must, in his opinion—be reduced from 65 francs per 100 k. to 15 francs. Even then it would amount to a duty of 80 per cent on the value of the article.

He very truly points out that there is no reacon why France should not preserve fruit for the British market if a moderate duty on sugar permitted.

There is one hope for the future of sugar which M. Seblime fails to observe—the large and constantly increasing demand for sugar in Eastern countries. This has helped during recent years to keep up the price, and to a certain extent to mitigate the present unprecedented fall. It is possible that in the near future this new demand may become still more developed, and bring to the present apparently hopeless crisis in the French sugar industry an unexpected salvation.—George Martineau in Sugar Journal.

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THE EAST INDIAN SUGAR INDUSTRY.

It is generally overlooked that the Indian sugar industry and the interests of the few existing sugar factories and refineries are not necessarily identical. The cultivator is, and, for many years to come, must be the backbone of the country.

Of the cultivators who grow sugar cane, what percentage have ever seen, much less dealt with, a sugar factory run on European or similar lines? When the existing countervailing duties were imposed, was there rejoicing in the homes of the cultivator? I most emphatically say that the vast majority of sugar cane growers in this country are this day utterly ignorant of the benefits of this particular piece of legislation, ostensibly undertaken on their behalf. Indeed, I go so far as to say that for practical purposes the Indian cultivator is absolutely indifferent to the effects of bounties, cartels and countervailing duties, and that all these considerations lumped together interest him far less than meteorological conditions which control the prices of grain, and enhance the risk and possible loss from a failure of a cane crop which, be it remembered, is a twelve months' crop; whereas, if a cultivator loses a grain crop, he hopes to make something on the next. It should be borne in mind that when we hear of the threatened extinction of the Indian sugar industry as the result of bounties, it simply means that the manufacture of sugar on European lines by the few factories of which the country boasts is likely to become unprofitable; but that this would seriously affect the cultivation of the sugar cane as it has been carried on from time immemorial, I deny.

Whether beet or refined cane sugar be sold in the bazaar, the native will still require the indigenous sugar cane. To the proprietors of the European sugar factories and refineries in India, the case is, of course ,entirely different; but in their case the outcry against bounties is made to cover a multitude of sins. I contend that were Indian sugar refineries called upon tomorrow to compete on absolutely fair terms with the continental beet refineries, they would be worsted in the encounter. To go back to the days before we heard about Continental beet in India. What caused the country to be dotted here and there with the ruins of disused and dismantled sugar factories? Competition for raw material—or injudicious selection of site—either as regards manufacturing facilities, procurement of raw material or markets for finished by-products. These are the causes that brought many a factory to grief in bygone days, and these same causes are most acutely felt in more than one Indian factory at the present moment, aggravated in some cases by excessive capital charges due to buying out rival factories, the competition of which for raw material, where the supply was strictly limited, necessitated some such action. Obviously, the limited supply of raw material, in conjunction with the greatly enhanced capital, demands a higher selling price to give a profit. Yet, in spite of past lessons, there are rumors of fresh development in this direction. The new ventures, of which we hear now, are being started to work in conjunction with, or in supersession of, indigo in Upper Bengal, will undoubtedly start under more promising auspices than some of the older sugar concerns, their promoters being in a position to profit by mistakes of those who have gone before them. For instance, it seems hardly credible, but it is a matter of history, that an Indian sugar factory should be started in a neighborhood where there was absolutely no water fit for manufacturing purposes; that another, after many years work, should find the cane grown in its vicinity—from a refiner's point of view—the worst cane grown for hundreds of miles around; that another factory started with a great flourish of trumpets, found, after a few months' work, that it could not get sufficient material of a workable kind to keep it going, and had to be practically dismantled and re-erected elsewhere! Want of capital pure and simple has closed the doors of others, but the crux of the whole question is the scarcity of workable materials. This was plain enough at the time of the passing of the first Countervailing Duties Act. There was a rush for raw material. Mauritius, Penang and Ava were all exploited and, by the way, came out of the experiment better than India did; the material thence obtained requiring plant and treatment which the Indian factories were not in a position to bring to bear upon it. However, the purchase of foreign material was scarcely what the Government of India wished to bring about when imposing the countervailing duties.

Originally the sugar factories in India were dependent on cane. Circumstances, however—in most cases, though not all, the increasing difficulty of getting enough cane—led to their falling back during a part of the year on refining from native raw sugars, of which cane and Palmyra "paggeries" are the most important. As a general rule the former is so spoiled by the native method of preparation that the refiner cannot afford to pay the price that the cultivator can get for it in the local bazaars for domestic purposes. Where it is produced near enough to a port, it is shipped in considerable quantities for certain uses in Europe where its high glucose content is rather an advantage than otherwise. This, however, does not help the Indian refiner. Much the same applies in the case of the Palmyra jaggery. It also is spoiled in process of manufacture, and it is only in certain districts that the material is produced in a state that allows the sugar refiner to utilize it as a "raw." This means that the supply is limited and that practically there is not enough to go round.

The countervailing duties have undoubtedly brought money into the Government Treasuries, but they have not enabled the refiners to get over the raw material difficulty; and still less have they benefited the cultivators as a body; though they have made them pay a little more for the luxury of refined sugar and sweetmeats made therefrom. The enhanced duty will, no doubt, help the planters and others who are putting down central factories in the midst of large sugar cane growing areas, but they will not outweigh the heavy cost of transport of cane or inferior raw material in the case of the factories which are unfortunately obliged to go far afield for their supplies, already artificially enhanced in cost by competitive buying.

There is no doubt that the alacrity with which Indian refineries began purchasing and inquiring after foreign raw material after raising the cry of the ruined Indian sugar cultivator was not forgotten by Government when framing the new scale of duties. Hence the disappointment in some quarters with the measure which has now become law.—Friend of India.

*THE ORANGE IN SOUTHERN CALIFORNIA.**

By J. W. Jeffrey, of Azuso.

The south has practically settled upon two varieties as the standards for general cultivation. The first in importance is the Washington Navel. Public sentiment, both from the growers' and from the consumers' standpoint, has always given this orange the preference. The tendency of this variety to sport back to worthlessness, and the consequent mistakes of the early propagators in their selection of stock from which to grow trees, are the only valid arguments that have ever been used against the general adoption of this orange. Later years have shown that a typical tree once established will always remain so, and that has thrown the burden of purity of stock upon the nurserymen. Planters understand this so thoroughly that they now spend more time in the selection of their nurserymen than formerly, and the younger orchards are coming to maturity with a minimum of "sports" and in many cases a full complement of typical trees. Tens of thousands of dollars have been spent in budding-over off-quality Washington Navel trees, but the progress of today recognizes very little necessity of starting an orchard subject to this fault. Perhaps these weaknesses in this variety have caused its utter failure in Florida, and this may be another case of compensation. At least it is not a cause of anxiety upon the part of California growers.

The other standard orange is the Valencia Late, a somewhat seeded variety and hence not subject to the inconstancy of the Navel, and rarely if ever missing in typical quality through the faults of the parent tree. This orange, in a few localities, vie with the Navel for supremacy of acreage, but generally is of small importance in the crop totals. It is not prepossessing in color, it is uniform in quality, size, and productiveness, and could it be shipped skinless would sell better upon its color, texture and solidity.

There is nothing new in the practice of preparing the ground for trees. Experience has shown that the land must be graded with special reference to its irrigation. There are many misfit orchards among the oldest plantations in this respect, entailing great loss in the congestion of fertilizers, inequalities in irrigation, and impossible irrigation in some cases. The intelligent planter no longer prepares his land improperly or by fixed rule, but proportions his grade as far as possible to the character of his soil and the methods of irrigation he wishes to use. I need not describe the different plans of orchard formation. The square, the five square, and

*Proceedings of Twenty-sixth Fruit Growers' Convention of California.

the triangular each has its advocates; but since the orange has been found such a ravenous feeder that its roots soon ramify its feeding-ground entire, we hear little of the arrangement of the trees, but much of their planting distances.

Aside from the fact that the square formation has the advantage of all others in economy of cultivation, especially in alluvial soils where the ground near the trees does not need cultivation, it has been found advantageous from the fumigator's standpoint. There is nothing more bothersome to the tent men upon a dark night than to keep tab upon every tree in a five-square or triangular arrangement. As to subsoiling, that is not practiced extensively of wet years, and may be superceded altogether by the orchard plow. At any rate, the square method allows sufficient room for the subsoiler, even far more than one furrow to the row, which gives the same results as is claimed from the other systems of planting. Plant in square 20 feet across if your land is not strong, 22 to 24 feet where the soil is heavy and the tree growth abundant.

It is impossible to fumigate many of the old orchards because of the interlocking of the branches, and the error of close planting will hereafter be carefully avoided for this and other reasons too well known to require notice. On the experience that the greater feeding area a tree is given, the less its liability to dangerous fluctuations in vitality add consequent effects upon the quality of the fruit, the average planter would advise 22 by 24 feet as the proper distance to plant, both from the economies of orchard work and from the quantity of merchantable fruit produced.

There is something new in cultivation. Last year Southern California grew the largest and the least resistant crop of oranges ever produced. Among the other reasons given for this, is shallow cultivation, and, following, shallow irrigation. In the wake of these extremely dry seasons came a persistent hardpan, even in alluvial soils. This produced a tendency to strangulation of the deeper roots and a consequent activity of the surface feeders. These surface roots were fed the fertilizers the whole root area should have had, and, being constantly stimulated by irrigation, constantly stirred to hardpan by the teeth of the cultivator, and scalded by the hot sun, the functions of the entire tree were in a state of unrest and partial impotency. It is not impossible that this constant arresting and forcing of the development of the fruit caused the sweetening of the pulp observed in October, the lack of oil formation in the skin cells, and the non-union of the rind and pulp—all so noticeable in last season's crop. At any rate, as soon as the 20-inch rainfall of last winter penetrated the hardpan the trees resumed their normal functions with their old-time vigor, and now it is a laborious process to separate the rind from even a ripe orange, and impossible to find an abnormal crop in other respects. These points may be thought somewhat theoretical, but they have brought conviction to a large number of practical men, who will hereafter, in the event of a dry, hot season, use the orchard plow to train the tree roots down to a safer feeding surface by preventing the formation of a dust pan. In spite of the adversities of last season, I know several cases of deep plowing which held the fruit intact until May, while many in the same locality were compelled to harvest their crops in early winter where shallow cultivation had prevailed. If the experiences of the past three years have demonstrated that dry-crops may be improved by superior cultivation, a repetition of the troubles that befell the orange-grower last season may be avoided in the future.

In the pruning of orange trees there is not a new item to present. Elaborate articles have been written on this point, but the practical orchardist does little or no pruning. To look after the water sprouts that may distort his trees, and to trim out the branches that die of inanition and thus give the tree an inside bearing surface, are about the limits of orange-tree pruning as practiced by the best growers. The orange tree will produce fancy fruit grown so near the earth that it may ripen in the sand, and indeed the best fruit is usually found upon the lower branches.

The question of the adaptability of soil is no longer an open one. It has been settled so thoroughly by experiences that the new investor can avoid mistakes by a tour of investigation. Generally, lands which bear light, regular crops produce a somewhat superior orange, while the heavier lands produce slightly inferior fruit, but heavier crops. Modern methods of fertilizing have modified these characteristics until it may be broadly stated that there is only an immaterial difference in the fruit grown throughout the true citrus belt. A problem in regard to fertilization presents itself this season for the first time. The facts are that hundreds of groves where hardpanning had occurred for two or three years carried the annual or semi-annual applications of fertilizers to the beginning of this year with but partial assimilation. The light rainfall, the sparse irrigation, and other deficiencies caused by three consecutive dry years, together with the light cultivation, must have prevented the utilization of the fertilizers. This has brought a strange experience—the finest condition of trees ever seen, with the lightest crop ever grown from an equal foliage surface. The conclusion is that the trees last winter were supplied with a suprabundance of wood-growing, but not sufficient fruit-producing, elements. There is a field for investigation here that the scientific authorities should exploit.

The question of insect disinfection is too large to cover in a paper of this character. In a majority of the citrus growing sections unclean fruit bears its own penalty in washing charges, in falling to lower grades, and in disrepute it brings to the orchardist. Fumigation is more universal this fall than at any other time. It has been reduced to a science, and while the practice is not always successful, poor work is no longer tolerated without a penalty upon the fumigator. There is little complaint of impure cyanide, but much of its improper application. Daylight fumigation, or more properly warm weather fumigation, is under ban, but many otherwise practical growers have not discovered it. Two or three of the leading citrus counties do this work at the treasury's expense, afterwards collecting from the lands treated. Los Angeles County still requires the orchardists to do their own fumigation. No new scale pests have developed since the last reports were out, nor is there evidence that parasites have taken the contract to disinfct the orchards of Southern California.

Upon the question of marketing you have heard a greater voice—one that has been heard all along this coast and its influence felt. It is not boasting to say that Southern California has set the pace for cooperative effort among all other farming communities. Great as the actual achievements in this line have been, greater is the feeling of permanent security that has been engendered by th success of the Citrus Fruit Exchange. Were it not for the work of this cooperative institution, there would be no breadth nor vitality in my subject tonight. The association has given to the agricultural world its greatest example of the elimination of the unnecessary elements of a great industry, without the formation of a trust. It has increased the profits of the producer without taxing the consumer to do it. The manipulator, speculator, and even honest but depleting fruit merchants have been apportioned to thirty or forty per cent of the orange crop. They hold on to that through a strenuous endeavor that would appall even our great President. The idea of charging producers just what it costs to sell their fruits has unified the policy of 4,000 orange growers, and made the Southern California Fruit Exchange the greatest fruit merchant the world has ever seen, giving that organization the record of handling millions of dollars every year, with losses from collections and disbursements so small that they do not amount to the value of 15 carloads in an aggregate sale of 25,800 carloads made since the Exchange assumed control of its own fruit from the orchard to the market end of the line.

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A tree has been found not far from Fresno in California the trunk of which is fifty feet in diameter six feet from the ground—that is, wide as two city lots. Fortunately it is on a

Government reserve and will escape the woodman's ax. Such a natural wonder should be preserved with the utmost care. It should be guarded by a dozen special keepers. There is nothing equal to it in the world. It counts with the geysers.

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EVOLUTION OF THE SUGAR MILL IN HAWAII.

By C. Hedemann.

The following article is not written for plantation people as it contains nothing new to them, but the writer has endeavored to comply with a request, to present in this paper some plain facts, easily comprehended by people whose business is not sugar making, concerning the advantages the great industry has derived here from the introduction of the modern, improved sugar mill.

Let us divide the sugar house work into two main branches:

1st. The extraction of the juice from the cane, and

2nd. The making of sugar from the juice extracted.

The means employed in all the Hawaiian sugar houses, but one, where the diffusion process is used to extract the juice and sugar from the cane, is milling. It is by far the most important process in the sugar house work for the simple reason that every particle of sugar left in the bagasse, crushed cane, leaving the mills, goes into the furnaces as an absolute loss, whereas an apparent loss in any of the boiling processes, may be partly, or wholly, recovered afterwards in a different form.

The history of the Hawaiian cane crushing mills may be divided into three epochs:

1st. The single three roller mill used here exclusively up to 1885 and later.

2nd. The addition of one or two 2-roller mills to the original 3-roller mills in all our sugar houses.

3rd. The introduction in 1894 of the 9-roller mill.

Owing to the lack of proper chemical control to within the last eight or ten years, we have but few data from which we can deduce an exact comparison of extraction obtained in the various 3-roller mills. It is, however, necessary to use some few simple calculations in order to explain the comparative value of the various styles of mills, but it must be understood that while the following calculations and deductions are not exactly "chemist proof," they may serve well enough for the purpose of this article.

It may be safe to state that 60 pounds of juice extracted from 100 pounds of cane was considered ordinary, satisfactory mill work, and 70 pounds of juice from 100 pounds of cane exceptionally good extraction in a single 3-roller mill, as such mills were constructed then. Supposing, therefore, that

65 pounds of juice extracted from 100 pounds of cane was good average work, and that a mill with rollers 34 inches in diameter and 78 inches long would consume then, as now, 1,000 tons of cane in 24 hours. The 1,000 tons cane would then be converted into 650 tons juice and 350 tons of bagasse. Assuming further that the cane was made up of

11.22	per cent fibre,
15	per cent sugar (pure),
73.78	per cent water and impurities
100.00	

and that the juice contained 17.13 per cent of pure sugar, we would send 150 tons pure sugar in the 1,000 tons of cane through the mill every 24 hours. Of this we would recover 111.3 tons sugar in the juice going to the boiling house, or 74.2 per cent of total sugar in the cane, and the balance of the 150 tons sugar, or 38.7 tons, would go out with the bagasse and be totally lost in the furnaces under the boilers. If we could recover this sugar, it would make about 35 tons commercial sugar, deducting loss in manufacture, and at $60.00 per ton would be worth, $2,100, which sum therefore may represent the daily sugar loss grinding with a single old fashioned 3-roller mill 1,000 tons of cane a day.

But the sugar carried off in the bagasse was not the only loss. Besides sugar, the bagasse held about 57 per cent of its weight, or 199 tons in water, and all of this water had to be evaporated before the bagasse would burn, and it required coal at a rote of 1 pound to 1½ and 2 pounds of sugar made, to do this in many sugar houses. The writer has seen as many as 20 to 30 laborers spreading such bagasse from a small mill on the ground and ripping it open by the hands so that the sun could dry it before it was gathered and carried into the open sided bagasse houses where it took from 2 to 3 weeks to dry it so that it would burn.

It is to Mr. Alexander Young that the honor is due for the introduction in the Hawaiian sugar mills of the additional 2-roller mills. The great advantages the planters derived from the use of one or two additional 2-roller mills arranged to grind the partly crushed cane from the single 3-roller mill, were then, comparatively speaking, of vastly greater importance than any other mill improvements which since then have taken place. These advantages were principally three-fold, viz:

1st. The additional crushing of the partly ground cane, producing a much better juice extraction.

2nd. The moisture in the bagasse being reduced to such an extent that the bagasse would burn directly as it came from the mills after the grates had been reconstructed, and thereby making it possible to get along without extra fuel, saving the enormous expense of coal and wood.

3rd. The application of hot water, maceration, to the partly crushed cane passing between the mills, thereby assisting the mechanical "squeezing out" of the juice by washing the sugar out of the opened cane cells, resulting in greater sugar extraction than it had so far been possible to obtain.

The necessary limit of this article will allow but a brief statement of what extraction could be accomplished by such a milling plant, and we will therefore only consider briefly the very best results obtained to the writer's knowledge.

In a milling plant consisting of one 3-roller and two 2-roller mills fitted with hydraulic pressure regulators, revolving knives cutting the cane down to an even feed to the first mill, with a liberal application of hot maceration water between the mills and all the mills being worked to their greatest advantage during a series of test grindings, the highest extraction obtained was 88.5 per cent of total sugar contained in the cane. If, for the sake of comparison, we assume that the same quality of cane was ground during this test as we used in the case of the above 3-roller mill, which is not improbable, we have in this 7-roller mill obtained an additional gain in sugar of 14.3 per cent of the total sugar in the cane. In a 7-roller mill with rollers 34x78 inches grinding 1,000 tons of cane in 24 hours, this would mean an extraction of 132.75 tons of sugar going with the juice to the boiling house, and 17.25 tons of sugar being carried off to the furnaces with the bagasse. If these 17.25 tons of sugar could be recovered, they would make about 15.5 tons commercial sugar for shipment and at $60 a ton, would represent a daily loss of $930. As the above described work of a single 3-roller mill, under even conditions, lost daily $2,100, we have in reality gained the difference, or $1,170 worth of sugar per day by the use of the additional mills.

The capacity of a mill depends mainly upon the length of its rollers, and the extraction should be as good in a small as in a large mill, within reasonable limits, provided the strength of the construction, shafts, gears, etc., will allow the required pressure to be applied on the cane. Sixty-five to 70 tons pressure for every foot of roller is the limit observed by the writer as used on mills regardless of size. An old-fashioned 30x60 mill, constructed like the above-mentioned 7-roller mill, would grind about 400 tons of cane in 24 hours, producing about 50 tons of sugar in that time. We may deduce from the above that this mill would gain $372 worth of sugar per day over a single 3-roller mill of same size and grinding the same kind of cane, so during the grinding of a 5,000 tons of sugar crop in 100 grinding days, the total gain would be $37,200. But as said before, this was an extreme test case, 5 and 7-roller 30x60 mills did not usually get such an extraction, and but few mills ground 24 hours every day. Even by greatly reducing the above total gain, these rough figures easily bear out the well established fact that the cost of the additional mills was nearly always regained during the first season by the additional sugar recovered by them. There was also an enormous saving in the extra cost for fuel. It is no wonder, therefore that every Hawaiian sugar house was supplied with additional 2-roller mills during the years from 1885 to 1893.

The next great epoch in the Hawaiian mill evolution was inaugurated by Ewa Plantation Co., when in 1894, on Mr. H. P. Baldwin's recommendation, they imported the first 9-roller mill from Fulton Iron Works Co., St. Louis.

The principal feature of this milling plant is three 3-roller mills resting on one bed and coupled up to one common gearing, giving each succeeding mill a slightly increased speed over the former mill, and all driven by one engine, generally of the Corliss type with automatic "cut-off," insuring regular speed. Each mill is fitted with independent and adjustable hydraulic pressure on the top roller, ranging from 300 to 450 tons. The main point which gives this style of mill such a great advantage over the former 5 and 7-roller mills, is the absolute uniform relative speed, and therefore feed, of the mills, the most essential requirement for obtaining the best possible extraction of juice. If a train of mills are coupled to separate gearings and engines, it is practically an impossibility to adjust the speeds of the mills properly in relation to each other. If a block of cane occurs in one mill, the first one for instance, and it is slowed down a moment to let it pass, the other mills will meanwhile run at their usual speed and a thin, uneven feed will be the result until the cane from the first mill reaches the other mills, and not before then is good grinding resumed. As this often happens every day with separate mills, the good extraction will be badly interfered with. Coupled to one engine, the mills will all slow down, and speed up. simultaneously, and the even- blanket-like, feed will never be disturbed.

By analyzing the extraction in each mill and adjusting the hydraulic pressure and opening between the rollers, the engineer can readily procure the best results from the various kinds of cane delivered to the mills.

In all the large new 34x78 9-roller mills, and in a number of the 32x60 9-roller mills in the islands cane preparers are now installed in connection with the first mill. These are either two fluted and grooved rollers as made by the Fulton Iron Works Co., two deeply cut zig-zag shaped rollers meshing into each other, as made by the Krajewsky-Pesant Co., or the two fast revolving drums with conic rings shredding the cane lengthwise, called the National Cane Shredder. These machines have all the same object, to prepare the cane before it enters the first mill by cutting it up in small pieces, filling up the holes between the rollers, and evening out an irregular feed of the cane. The result obtained is not so much marked by an increased extraction in the mills, as it is by increasing the capacity from 20 to 30 per cent, and securing regularity of feed, the great point in milling.

A modern mill consists therefore of eleven rollers through which the cane passes, getting seven crushings. The bagasse escapes finely divided and is fed automatically to the furnaces, and with a moisture content of about 43 per cent it burns freely, and furnishes ample steam for all sugar house work and 17 to 18 per cent of hot maceration water can be applied to the partly ground cane between the mills, greatly assisting the sugar extraction.

Owing to the perfect chemical sugar house control now established in all the new modern sugar houses, we are able to determine exactly what results are obtained in such milling plant. The following figures are computed from the average results obtained in some of the large plantations on Oahu using artificial irrigation and having cane of the following comparison:

CANE.

11.21 per cent fibre.
15. per cent pure sugar.
73.78 per cent water and impurities.

EXTRACTION.

93.086 per cent of total sugar in cane.
82.47 per cent juice of weight of cane.
13.97 per cent sugar of weight of cane.

BAGASSE.

22.46 per cent of weight of cane.
1.033 per cent pure sugar of weight of cane.
44.293 per cent water of weight of bagasse.

Let us see what these figures mean. 13.97 per cent sugar extraction and 1.033 per cent sugar lost in bagasse added gives 15 per cent sugar as the total amount contained in the cane. Supposing, as in the former case, that we grind 1,000 tons of cane in 24 hours, we enter 150 tons pure sugar with the cane into the mills; and of this 139.7 tons of pure sugar is extracted and goes to the boiling house, and 10.33 tons pure sugar is carried with the bagasse into the furnaces and lost.

These 10.33 tons of sugar, if recovered, would perhaps produce 9.3 tons commercial sugar, and this at $60 per ton represents an actual loss of $558 per day, grinding 24 hours and 1,000 tons of cane consumed. As the daily loss in the former 7-roller mill was found to be $930 per day, during the best possible work under the same conditions, we have gained daily $372 by the introduction of the 9-roller mill.

It may shock the sugar-interested reader to consider that in a sugar house making 20,000 tons of sugar in a season of 155 grinding days using for this 155,000 tons of cane, $86,490 worth of sugar in the season is still burned up in the furnaces, but it may be a consolation for them to know, that at least $57,660 more would have been lost, if this crop had to be ground in the former 7-roller milling plant.

Sugar people in Louisiana and Cuba have on occasions argued with the writer that but small benefit was derived from a third mill, and that in their opinion two 3-roller mills and cane crusher would extract from the cane all the sugar possible to obtain by means of milling. It may in this connection be interesting to note the following "case" which well demonstrates the use of the third mill. At Ewa mill the shaft once broke in one of the rollers of the third mill. For 19 days they were grinding with but the two first mills, until the new roller arrived. While grinding with all the three mills, the bagasse contained 1.053 per cent sugar of weight of cane, but while grinding with two mills only the bagasse contained 1.665 per cent sugar of weight of cane. The loss was therefore 1.665 less 1.053 equals .612 per cent of sugar of weight of cane, and as 15,007 tons of cane had been ground during the 19 days, the total loss of pure sugar was 91.04 tons, which would have produced about 83 tons of commercial sugar and would at $60 per ton, be worth $4,980; which sum then represents the actual loss on this account in 19 days.

The 9-roller mills in the Hilo district grinding natural irrigated cane with high sugar contents and purity of juice, obtained during the last season an average extraction of 94.72 per cent of total sugar in the cane, which would show better results than those stated above.

In concluding this article it may be repeated that all the calculations and figures mentioned have merely served as illustrations for comparison between the various milling plants, and should therefore not be used for other purposes.

The results in connection with the 9-roller mill are computed from the annual reports of plantations on Oahu.

As will be noted in spite of the enormous expenditure in new and improved milling machinery in Hawaii during the last 15 years, and the great skill and ingenuity displayed by experts and engineers whose sole object has been to prevent the great loss in the bagasse, there still remains an enormous loss which will present more difficult problems to be solved than has been the case before, because it involves the extraction of the last traces of sugar contained in the cane.

Honolulu, Dec. 30, 1901.—P. C. Advertiser.

PRESERVATION OF THE FORESTS.

The question of forestry is now, I am glad to see, taking up a considerable portion of the space of the Agriculturist, and is a step in the right direction, and I hope that the good effects of these articles will soon become apparent in a united effort to take some steps to preserve our forests. It is very easy to talk and plan but what good will talking and planning do without action.

First among the destructive forces come the numerous fires that annually sweep over our wide stretches of uninhabited lands, generally leaving the forest bare of undergrowth and if not entirely killing out the young trees, so injuring their vitality that their after growth is slow. By checking these fires, this young growth will be saved to take the place of the mature trees which are cut out for various purposes, and will also preserve to the soil much fertility that the country can ill afford to lose. Fires are usually the result of carelessness; sometime they start from the stump of a cigar thrown carelessly by the wayside, sometimes they are set to burn off the woods for early pasturage and sometimes for the pure pleasure of "seeing the woods burn." On our western prairies there are occasionally to be found small elms, oaks and other trees, which were probably planted there by the agency of birds. These trees come out each spring and make a brave attempt to grow, but are usually checked by fire, after they recover from the shock, they put out and generally grow but little higher than the tops of the grass before the end of the season, the next season is a repetition, and so as long as that is a fire swept region, they are bushes. Where these fires have been prevented, the forest is slowly encroaching on the prairie lands. In early childhood days, I was in a portion of eastern Kansas much used for grazing lands. In some parts of this country a growth of young oaks covered the face of the prairie, all of uniform height and character. They were, at this time, only a few feet in height. In a few years, I chanced to be in the same region again, and the young oaks had become respectable saplings; by this time they are undoubtedly "sturdy oaks of the forest." If fires had swept this section each year, these trees would still be in their infantile condition.

With our magnificent forests, it is hard to realize that some day it may be necessary for us to aid nature in their reproduction, but it would be a wise move to take time by the forelock and prevent the possible necessity for replanting the trees by protecting those that nature has already planted. An ounce of prevention, you know, is worth a pound of cure, and time spent in vain regrets is time idly wasted. Better be up and doing now.

We all know too well the inroads that the lumber man and the turpentine man are making, and also their careless methods, practically destroying everything in the tracts of timber they operate upon. Some farmers have foresight enough to refuse to part with their timber tracts to these people, but stern necessity causes many others to sell their timber. A strict contract should be made with every sale, that the young timber be left unhurt. To be sure these are both legitimate pursuits, but something should be done to make those engaged in the business more careful of that timber which they cannot use and which, if cut or broken down, if of no use to anyone else, when if left standing, it will prove a source of wealth in the years to come.

If our people could be educated to plant a seed in every spot where a tree could grow conveniently instead of cutting down and grubbing up the young trees, to handle fires with more caution and keep them out of the timber lands, to see that the young timber is preserved from the onslaughts of the lumber and turpentine men, this great source of natural wealth would be in no danger of destruction in a few years, but would constantly replenish itself as the years roll by and become more valuable instead of dwingling in value. Let us hope that the day is not far distant when the state shall have a guardian of the forest in every community whose duty it will be to see that the forests are preserved from wanton destruction.—Cor Florida Ag.

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A SUBSTITUTE FOR CANE PLANTING.

A late dispatch from Havana, Cuba, tells as follows of a proposed change of agricultural pursuits on that island, saying:

The sugar industry may be a thing of the past in Cuba, and another industry, which will not be uncertain, bids fair to take its place. This industry is the raising of sea island cotton. Experiments in the growing of this useful and always marketable staple have shown that it can be grown here with wonderful results. So well does it grow here that it almost doubles in its return to the acre any other country of which there is any record.

Sea island cotton has been grown here within the last year, and it has yielded all the way from 1,500 to 2,000 pounds to the acre. The average in South Carolina, where the product is grown to some extent, is 700 pounds to the acre, and the cotton is not to be compared, say experts who have handled the two, to that which is grown here. The industry has been considered so important that there is already on American company which is preparing to start in the business on a large scale. Modern machinery for ginning the product has been ordered and the land leased. It is understood, however, that the government will try to encourage the smaller farmers to take up the industry, as experience has taught that great plantations, where the planter is lord and those under him slaves, are not nearly so good for the country as many small farms where the owner of each is independent.

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IMPROVEMENTS IN SUGAR REFINING DURING THE LAST TWENTY-FIVE YEARS.

By T. L. Patterson, F.I.C., F.C.S.

Sugar refining is a physical and mechanical, rather than a chemical process. Briefly stated, it consists in the dissolution of raw sugar in water; filtration of the liquor through cloth to remove insoluble impurities, and through animal charcoal to remove color; and finally, concentration of the decolorized liquor to obtain crystals. But it depends largely on chemical analysis for the determination of the composition and value of the raw material and for checking the various processes in the refinery. Hence the staff of no well organized refinery is complete without one or more chemists, although very few chemicals are used in the process itself.

On the Continent, chemical processes are wholly in use for the removal of coloring and nitrogenous matters from beetroot juice. These consist for the most part in the treatment of the juice with alkaline earthy bases, zinc, iron, and tin salt; carbonic, sulphurous, and hydrasulphurous acids. Electricity, too, is on its trial for the same purpose and for the partial removal of mineral salts. Some of these chemical processes have been adopted for the treatment of cane-juice in the Colonies, but none have been introduced into this country, except perhaps in a very modified way, because they are not applicable to British methods of refining. Sucrose undergoes inversion and decomposition so easily, and is so closely related in composition to some of the impurities to be removed, that treatment with strong chemicals is out of the question. For this reason animal charcoal still maintains its position as a decolorant in the production of the highest class products, as well on the Continent as in this country.

No revolutionary change has taken place in the refining industry during the last 25 years, but many improvements on the old physical and mechanical processes have been made and introduced. The first of these to which I am about to direct your attention consists in improved methods of washing raw sugar in the centrifugal, just introduced by Weinrich prior to this period, with steam, or with hot or cold water.

The process was afterwards improved by Duncan and Newlands, Walker and Patterson, and others. Theoretically, raw sugar may be said to consist of pure sugar crystals and molasses. The object of the process is therefore to wash out the molasses, and raise the standard of the raw material—chiefly beetroot sugar of low quality—to that of the higher grades, and make them suitable for the production of the highest quality of refined sugar. For this purpose raw beetroot sugar of 75 per cent to 80 per cent net analysis is filled dry into the centrifugal, or mixed with syrup or water, and transferred to a centrifugal machine. After spinning out the syrup added or made, the sugar in the machine is washed with water or steam until most of the molasses is removed. The product which still contains all the insoluble impurity and some of the coloring matter has been raised in quality, though reduced in weight, to an analysis of 90 per cent to 95 per cent net. The process separates the raw sugar into two products, viz., (a) the partially purified or washed crystals, which are submitted to the ordinary process of refining for the production of white crystals, cubes, or granulated; and (b) the washings, containing the molasses which go to make yellows and syrups.

In the filtration of sugar liquors, filter-presses have been introduced with marked advantage, but in most refineries the old Taylor filter, with in some cases trifling modification, still holds its own. There is room, however, for a greater use being made of the filter-press than has yet been done. Sometimes when filtration is difficult, a precipitate of phosphate of lime is brought about in the solution which coagulates gummy and gelatinous matters; or sand, kieselguhr, or other inert matter is added, to prevent them from choking the pores of the filter cloth and thus facilitate filtration.

Animal charcoal is still the chief or only decolorant used in the refining industry. It is supplemented in many refineries by the addition of sulphurous acid in the gaseous state or in solution to the filtered liquid. The acid bleaches the yellowish liquors from the char to a considerable extent, and any excess is expelled in the after process of concentration. With the exception of phosphoric acid solutions, carbonate of lime, lime, and sulphuric acid for syrup inversion, sulphurous acid is the only chemical now in use.

The process of concentrating and graining the sugar solutions—technically called boiling—is always conducted in vacuum pans which boil at a low temperature. No improvement worthy of remark has taken place in the apparatus itself. But improved evaporators have been introduced by Yaryan (1886) and Lillie (1888) in America, for the concentration of cane juice, char, and other sweet waters, which have found their way into the refining industry of this country. They are built either vertical or horizontal, on the multiple effet system so largely used on the Continent and in the Colonies. They consist of one or more vessels divided into three compartments. The central or heating chamber is filled with pipes which connect the feeding chamber at one end with the collecting chamber at the other. Thin liquor is supplied in a regulated flow to the feeding chamber, where it is distributed in films over the inner surface of the pipes heated by low pressure steam, and thence into the collecting chamber more or less concentrated. The vapor evaporated from the liquid is conveyed to the heating and the partially concentrated liquor to the feeding chamber of the next vessel, and so on for as many vessels as are in series, usually three. A good vacuum is maintained in the last vessel and the manipulation is the same as that in use with the old triple effet. The advantage of these evaporators is attributed to the great economy of heat, the small quantity of liquid submitted to heat at one time, and to the rapidity of evaporation. The liquid is only in the apparatus a few minutes before it is discharged concentrated to the desired density. During this time cane juice at 14° Brix can be raised to 51° Brix and water, equal to 72 per cent of the weight of the juice evaporated.

Whilst no great advancement has taken place in the construction of the vacuum pans in which sugars are grained, improvements have been made on the condensers, so that now two or more pans are worked in connection with one condenser. And in order to economize water, the condensers are made counter-current, that is to say, the water flows in the opposite direction to that of the vapor.

Some progress has been made in the method of boiling crystals on the lines of a "seeding" process introduced by Lebaudy of Paris some time prior to the commencement of the period under review (1865). This process has grown in favor and been largely adopted in the refining industry. To make the advantage of this improvement plain, it will be necessary in as few words as possible to describe the process of boiling. Large and well crystallized sugars, other things being equal, bring a better price on the market than small badly crystallized goods. Hence in boiling white sugars, except where granulated and cubes are required, the object of the refiner is to produce as large crystals as possible. With this end in view, it used to be necessary to start the pan with nearly pure sugar solutions, and when full of masse-cuite—that is a magma of sugar crystals and syrup or mother liquor—the pan was "cut" as it is technically called, that is half emptied, and the boiling process started again by feeding in more liquor. The crystals left in the pan grew larger with every increment of sugar solution, the motion of the boiling mass, and rapid concentration, until the pan was again full, when it was again cut. This process of cutting had to be repeated several times until the crystals attained the desired size, when the pan was completely emptied. Practically it is not possible to go on cutting indefinitely, because the boiling requires to be slowed down as the crystals increase in size, and the process would have to be greatly prolonged, making it very difficult to prevent the formation of new small crystals which must be sifted out, and injuring the color of the syrup from which the after products are boiled. In this way several lots of sugar are obtained, the crystals of which increase in size from the first cut to the last. As all are of the same quality, though differing in size of grain, the refiner's aim is to turn out each lot with large well formed crystals, which command the highest price.

To obtain this result, reduce the cutting and shorten the time of boiling, refiners now proceed as follows, viz., they concentrate some liquor in the pan to nearly the crystallizing point and add to it a proportion of the dried sugar from the first or earlier cuts of a former boiling. The operation is technically called "seeding" the pan. The added crystals or "seed" grow as boiling proceeds, and attain full size much sooner than they can do under normal conditions. A refinement of this operation consists in using foreign sugar crystals as seed and growing the sugor in the liquor on them. When the different pans from this method of work are mixed, all the crystallized products can be turned out of large and uniform quality.

With the same object in view, when two pans stand together, it is a common practice to connect them with a pipe closed with valves. One pan is boiled full of masse-cuite, which may be started from liquor alone or from liquor and seed, the connection between them is opened and the second pan partially filled from the first. Boiling then proceeds until both are full and ready to cut, or be emptied, as the size of the grain warrants. No improvement has taken place in the boiling of mediums and yellows.

The masse-cuites are dropped from the pans into mixers, whence they are delivered to the centrifugal machines in which the syrup is separated from the sugar. The sugar is more or less washed, discharged into bins, air-dried, and filled into bags for market. Hitherto the syrup and washings have been collected together, and a second quality of sugar crystals boiled from the mixture. In the process of washing, rendered necessary to remove the mothr syrup which adheres to the crystals, a considerable proportion of the sugar is dissolved and lost to the first product. This has always been a difficulty which refiners try to obviate by using as little water as possible, and carefully regulating that used to the class of sugar washed. But notwithstanding every care, 6 per cent to 15 per cent of the first products are washed into the second products, for which a lower price is obtained. A recent patent of my own (1897) has made it possible to separate in the centrifugal itself the washings from the syrup or mother liquor, so that washing may now be practiced with impunity. The washings, having the same purity as the liquor from which the sugar was boiled, are returned to the pan separately from the syrup and boiled up with liquor to produce first product sugar. In this way the loss from washing has been avoided. Several large refiners are presently erecting machines to work this process and good results are anticipated.

In describing the process of boiling crystals we excluded "granulated" and "cubes." Both are practically products of the last 25 years. No seed is used for either of these sugars as only small crystals are required. The masse-cuite for granulated sugar is treated in the centrifugal to separate the cyrup, after washing the moist sugar is completely dried in a Hersey, Newhall, or Gibb revolving cylinder through which a current of hot air passes. It is then cooled and packed for sale.

There are many patent processes for making cube sugar. Those which have been worked in this country are the Langen, Duncan and Newlands, Walker and Patterson, and the Adant. All are manipulated in much the same way. Masse-cuite boiled to a small grain is filled into moulds divided by partitions, so that the spaces between may form, when full, plates or prisms of sugar about five-eights of an inch thick. The moulds are either a kind of centrifugal basket, or made to fit neatly into centrifugal baskets. The masse-cuite is allowed to set and cool in the mould, when the crystals become cemented together by a secondary crystallization which takes place during the cooling process. The cooled moulds are then placed on a centrifugal spindle or in a centrifugal basket, and the syrup spun out. Whilst spinning the sugar plates are washed with claircee—a saturated solution of pure sugar in water—and when this too is spun out the moulds are removed and taken asunder. The plates are carefully separated and placed in a continuous mechanical or other stove, where they are dried in a current of hot air. The dry plates of prisms, now so hard that they have a metallic ring, are then transferred to a special cutting machine which chops them into cubes for market.

Besides the moulded masse-cuite processes just described, there are several others in which a kind of artificial massesuite is produced by mixing crystals, or crushed sugar, with a hot saturated solution of sugar. This mixture is then moulded into or plates prisms. Or again the sugar is moistened with water and pressed into moulds to form cubes or tablets, which are dried in the usual manner. None of these processes yield such a first-rate product as cubes made directly from masse-cuite, and need not be further referred to. The cube is such a convenient form of dry hard sugar, and its manufacture is now so perfect, that it has entirely supplanted the old form of loaf sugar in this country, the cutting of which was a most disagreeable household experience. Loaves are still made on the Continent, but their manufacture is rapidly dying out.

Passing to the residual products of the refinery we will consider an improved method of treating molasses, which in the beetroot sugar industry, because of the presence of a large percentage of lime and alkaline salts of organic acids, is the refuse of the process, only suitable for cattle feeding and distilling. It is called "Crystallization in Motion," many modifications of which are at work. The process was introduced on the Continent about 20 years ago, for granulating out the last available sugar that will crystallize. Patents were granted to Bock, Huck, and others, the latest improvement being perhaps that of Grosse. The apparatus consists of large cylinders or tanks, provided with a stirring arrangement kept in very slow motion, and in most cases surrounded by a jacket in which hot water circulates to control the cooling. It is often fitted with an air-tight door, and connected to the vacuum pump and air pump by pipes, that it may work under reduced pressure and be emptied by increased pressure when finished.

The low syrups or molasses are put into this apparatus after they have been boiled to the granulating point, when they are in a supersaturated condition. Stirring then commences and is repeated at intervals during 50 or 60 hous, whilst the contents cool down very slowly to about 50° C. controlled by the hot water jacket. Under this treatment the small crystals of sugar at first formed grow in the viscous mother liquid or molasses, and become large enough to be easily separated from the exhausted molasses in the centrifugal machine.

The process of crystallization in motion is an interesting one, because it overcomes a practical difficulty in a very simple way. It may be explained by considering what takes place when partially exhausted, concentrated molasses is slowly cooled at rest. Such molasses is a thick viscuous supersaturated liquid in which the free sugar molecules are held apart by the large proportion of organic salts and other organic bodies present in solution, and in which that freedom of molecular movement favorable to the formation of large crystals is entirely absent. Practically crystallization proceeds continuously as the solution cools, but theoretically, it is intermittent, and we can assume that several free molecules arrange themselves around another molecule in innumerable centres in the mass, to form small crystals. After withdrawing the free molecults in their immediate neighborhood, crystallization stops at these centres, and the crystals formed drop to the bottom of the cooler, or remain suspended out of the sphere of action. As cooling proceeds the solution again becomes supersaturated at the lwer temperature, and new crystals form in new centres, to drop out of action as before. In this way supersaturation and crystallization proceed together in different centres, and succeed each other, until the mass is cool, with the result that most of the sugar is crystallized in a very fine state of division, the greater part of which passes through the perforated linings of the centrifugals along with the molasses, and cannot be recovered. The motion of the mass under the influence of very slow cooling overcomes the difficulty of the formation of small crystals and prevents the mother syrup from reaching a supersaturated condition. The crystals first formed are transferred to new spheres of action, and the free molecules arrange themselves on the crystals already formed in preference to forming new ones. Thus the crystals grow as the mass cools, and the final product is a crop of crystals large enough to be easily separated from the exhausted molasses in the centrifugal machine. When the molasses contain very little sugar, as they often do, to yield a fair crop in this way, the masse is seeded with a proportion of crystals from a previous boiling to form crystallizing centres, and all the sugar that will crystallize is recovered. On the other hand, when the masse is too thick and viscous, a little thinner molasses is added to give that freedom of motion required. Usually the molasses from this process go to the distillery, or for cattle feeding. But as nearly all the cyrups in this country are refined and go into consumption as golden syrup, the process has only been adopted by one or two refiners.

The manufacture of golden syrup has greatly increased during the last quarter of a century. The quality has been very much improved by the use of high class syrups and sugars as the raw material from which it is made. On the other hand it has been much impaired by the use in large quantity of liquid Indian corn glucose for diluting poor syrups, improving the color and preventing granulations. Good well inverted syrups do not require this addition, nor is it practiced by the best makers.

The syrups and sugars used for making golden syrup require to be partially inverted to prevent the granulation of cane sugar in the finished product. For this purpose they are heated with a little sulphuric acid, which is afterwards neutralized with carbonate of lime and the sulphate of lime filtered out. The liquor is then passed through charcoal and boiled to the required density. Some refiners use yeast instead of sulphuric acid, according to Tompson's 1884 patent more or less modified. The action is slower than with acid, but it enables them to work without chemicals. Yeast added to strong solutions of sugar and heated to 50°-70° C. does not set up alcoholic fermentation. An objection to yeast is the introduction of organic impurities into the syrup which are not removed by charcoal.

White sugar is made on the Continent direct from beet-root juice by the chemical agents already referred to, without the use of charcoal. Many of the refineries, too, work without charcoal, but the products are never so pure and white as they are when this decolorant is employed. The best results and finest products can only be obtained with charcoal. Consequently in this country, where the public demand the best of everything, all refiners use char. As large quantities are required, at least one ton for a ton of sugar, it may be taken for granted that the char department is the largest and most expensive in a refinery. Any useful improvement introduced into this department will therefore be of value. And progress has to be recorded here as elsewhere in a refinery. It is chiefly mechanical, and consists of improved methods of handling the char. Formerly the char, wet from the filters, was delivered by hand to kilns with fixed burning pipes, drawn by hand from the coolers below into barrows and wheeled to elevators, often after having been spread on a cooling floor by hand, because the kiln coolers were too short to do their work.

Now, the wet char is delivered mechanically on to kilns in which the reburning pipes do or do not revolve. In its passage down the pipes the char is raised to a low red heat, which destroys the organic matter absorbed from the sugar. Below the kilns it enters ample coolers which are a continuation of the burning pipes, whence it is automatically discharged into receivers ready for use. Then, as it is required, endless bands carry it from the receiver to the elevator. Thus the char is almost altogether mechanically handled, little or no labor is needed from the time it leaves the filter till it returns to it, except that required to control the machinery, and distribute the char on the kiln-heads and filters.

Char kilns have been greatly improved by placing driers on the top, heated by waste gases from the kiln fires, an adaptation introduced from American practice. Wet char passing through these is delivered into the pipes dry. Thus, the driers do outside what was formerly done inside the pipe, and make it possible for each kiln to reburn the maximum amount of char.

Char is the great sugar refiner, and much care is bestowed on its manipulation. With repeated revivification, even in the best kilns, it gradually loses its decolorizing power, and after a year or two's use has to be turned out. The cost of renewing it is a serious item in the upkeep of a refinery. Two causes are chiefly responsible for the deterioration. One of these is the reduction of porosity brought about by the shrinkage of the calcium phosphate during successive reburnings. The other is due to the deposition of vegetable carbon, which has no discolorizing power on its surface and in its pores, by the carbonization of organic matter absorbed from the sugar. No remedy has yet been found for the former evil; but it has long been recognized that, were it possible to remove the vegetable carbon the latter would be taken away, the discolorizing power would be greatly improved and the life of the char prolonged. This is the problem refiners are now trying to solve, and already two or three apparatus are on trial in which char is burned in a limited supply of air. Chief amongst these is a cylinder with revolving paddles patented by Weinrich in 1896. It is in use in two or three refineries and good results are said to be got from the process. The patentee claims that impurities are oxidized at a temperature of 300° to 400° F. when this apparatus is used instead of ordinary kilns, but that a temperature of 600° F. is required when it is used as an auxiliary to these kilns. About the same time I was independently experimenting on the oxidation of vegetable carbon in char, and found that it was not removed in any appreciable quantity below a low red heat. At this temperature, however, the char is greatly improved by partial oxidation, and I am very hopeful that this process will prove of great value to the refiner.

Passing from improvements in the process itself, let me close this paper by a short reference to the commercial position of the industry during the last 25 years. Whilst there have been fluctuations, amounting to prosperity at times, though oftener to failure and loss, the industry, as a whole, may be said to have been on the down grade throughout this period. The decline was not caused by any want of enterprise on the part of refiners. What I have said tonight is evidence that they are not slow to adopt new processes, or improvements on old ones, which promise any chance of success. It has been almost wholly brought about by the action of foreign States who give bounties to rival refiners, which enable the latter to undersell homemade sugar in British markets. A few statistics will make this plain.

The consumption of sugar in this country, which was 860,000 tons in 1875, equal to 60 lbs. per head of population, grew to 1,489,000 tons in 1900, equal to 81.2 lbs. per head of population. During the same period, the sugar refined in this country fell from 760,000 to 610,000 tons. And the refined sugar imported—chiefly from Germany, Austria, and France

—steadily increased from 100,000 tons in 1875, to 950,000 tons in 1900. In other words, the consumption increased 81.5 per cent, whilst home refined sugars decreased 20 per cent, and foreign refined sugar increased 950 per cent. In 1875, 88.5 per cent of the sugar consumed in this country was refined in Britain and 11.5 per cent abroad. While in 1900 only 39 per cent was refined in Britain and 61 per cent abroad. These figures speak for themselves, and show the enormous injury done to this country by the imposition of foreign bounties. But for them the growth of sugar-refining would almost certainly have kept pace with the growth of consumption, and many of the refineries closed during the last quarter of a century would still be working profitably.

It is worth noting in this connection the diminution of refineries during the period under review. In 1875, 18 firms were refining sugar in London, and two new refineries were started a few years later, making in all 20 for London. There were 9 in Liverpool, 3 in Bristol, 2 in Manchester, 1 each in Earletown, Plymouth, and Newcastle-under-Lyne, 13 in Greenock, 1 in Leith, and 1 in Dublin; total, 52. In 1900 only 2 were working in London, 3 in Liverpool, 1 in Earlestown, and 5 in Greenock; total, 11. Deducting the latter total from the first we get 41 closed. To this has to be added another refinery, making 42 in all. For, some years ago, a firm of Liverpool refiners courageously tried to stop the import of foreign refined sugar on the east coast of England by establishing a refinery at Rawcliff, near Goole, which they worked on a continental model. But after a run of two or three years at great loss, had to abandon the project.

Thus we have seen that 42 refineries have been extinguished in Great Britain and Ireland during this comparatively short period. Speculation and other causes were in a measure accountable for the closing of some of them. But the baneful influence of foreign bounties was noticeable here too. For it caused great fluctuations in the production of beetroot sugar on the Continent, with even greater fluctuations in the price of the raw material. And refiners here, who have to buy ahead to supply their wants, became the victims of these unnatural movements. Although most of them made heroic efforts to survive, we need not wonder that some refiners succumbed in the struggle for existence against such odds. The wonder rather is that there are any left. The remnant struggle on, buoyed up with the hope that in the near future our Government will yet be brought to reason, and take some action which will prohibit the importation of bounty-fed sugar into this country, or by some other means equally effective, put a stop to the unfair competition of foreign refiners, and save from total extinction an old, honorable, and legitimate industry, which gives employment, even yet, to large capital and a considerable number of workmen.

When in spring last it became known that a duty was likely to be put on sugar, refiners were hopeful that the Chancellor of the Exchequer would make it differential, so as to recover the greatest duty from the sugars which received the largest bounties, but when the duty was declared it was found to bear with equal incidence on sugars of all origin, leaving the position, so far as the refining industry is concerned, practically where it was.

The above paper was read before the Society of Chemical Industry, and the discussion which followed it is inserted below.

Prof. Henderson congratulated the Section on having received so valuable an account of the present state of the sugar industry by an authority on the subject, like Mr. Patterson, to whom he was also personally indebted for information which had enabled him to compile a brief report on the same subject for another purpose. He suggested that Mr. Patterson might give the meeting some account of the results of the experiments on the cultivation of sugar beet in Scotland.

Dr. W. C. Anderson remarked on the low temperature (300—400°F.) at which Weinrich claimed to be able to oxidize the organic matter contained in the char, and asked whether the author's experiments tended to confirm this statement.

Mr. A. Macdonald said that the paper seemed to cover every modification and improvement during the last 25 years. He was not sure if the lime process had been introduced within that period, possibly not; hence the omission of any reference to it. It was painful to mark the enormous curtailment which had taken place in the number of the refineries of Great Britain, and though it was true that those remaining had increased in productive power, still the enormous increase in the imports of foreign refined, coupled with the decline in the production of home refined, was a clear indication of the disadvantages under which the home refiners labored, by reason of the bounties granted to foreign refiners. The margin between raw and refined beet sugar was now so small that a very trifling advantage one way or another was bound to determine the flow of business. For example, the price of raw beet sugar on the day of the meeting was 7s. 3d. per cwt., f. o. b., continental ports, on a basis of 88 per cent. The exact purity of 100 per cent on this basis, apart from the arbitrary irritating increase adopted by the trade, was 8s. 2¾d. per cwt. Now, as the price of foreign refined granulated sugar was then 8s. 3d. per cwt., f. o. b., it was clear that all the skill—all the scientific improvements in the world—could not effect economy enough to enable British refiners to compete against foreign refined sugar of the same character. It was only by variety, by greater skill, in enabling them to produce a better quality and an article of finer appearance, that the British refiners still existing had been able to hold their ground at all, in spite of the advantages of the differential rates between raw and continental refined sugar which enabled the refiner abroad to sell his refined product at practically the same price as raw.

Prof. Henderson had asked some question about the cultivation of beetroot and the extraction of sugar therefrom in this country. The cultivation of beet and the extraction of sugar on a practical scale in this country had only taken place at Lavenham, under the initiation of Mr. James Duncan, and at a time when the higher price of sugar, as compared with the present price, should have made the enterprise a success. Mr. Duncan did not himself grow the roots, but relied upon the co-operation and hearty support of the farmer. He merely laid down a factory with all the necessary means of gathering in the roots, but while he had equipped his factory for working a large quantity of roots, he never could get more than about a quarter of the quantity which his factory was capable of overtaking. For this reason alone the venture proved unprofitable. Nevertheless he wrote in the most confident manner about the value of beet as a crop and as an industry, and said, "no one knows better than I do the value of beetroot to a country, for, not only does its cultivation mean fertile lands and rich after crops, but it means abundance of cattle, and a contented and happy peasantry, because of the profitable occupation it affords to many people." Besides this practical experiment—for after all it was only an experiment—many trials had been made in the cultivation of beet, and within twelve miles of Glasgow, viz., at Bishopton, beetroot had been grown indicating a yield of as much as three tons of sugar per acre. What this meant could only be realized by comparison, but when it was seen that the German crop averaged 31 cwt. per acre, and that of France only about one ton, the possibilities of this country become plain. Indeed it might be laid down as a law that the moist climate of this country would enable a larger yield to be produced from our root crops than that of any other country. The question of ripening had yet to be answered by trial. Thus, our grievance against bounties, was as much because of the hindrance they had been to agricultural development and expansion, as it was because of the injury they had inflicted upon British refiners and growers of cane in the West Indies. For, had the Government fostered and guarded the cultivation of beet, at a time when every beet grower in Germany was driving in his carriage to church while other farmers walked, the agricultural situation of this country would have been saved, the repopulation of the agrarian districts stemmed, and the enormous and alarming increase of the larger cities checked. Mr. Patterson's paper was a valuable resume of the sugar trade, a kind of stocktaking for the last quarter of a century, and in a society connected with industry such as this was, it seemed desirable to take a look backwards in order to ascertain how far they had travelled and to take note of anything which had hindered their progress.

Mr. D. J. Playfair said that Mr. Patterson had made no reference to the strantia process for sugar refining, and asked if it were still in successful operation, or if it had been abandoned. With reference to the electrolytic process for refining sugar, Blount explained it to consist in using attackable anodes of either zinc or aluminium without a diaphragm, the resulting effect of which was to produce a hydrate of zinc or alumnia, which on settling withdrew some of the impurities from the sugar solution. Some bleaching effect might also take place due to electrolysis of the soluble chlorides present, and perhaps Mr. Patterson could say if this happened, and if so, whether it had the effect of producing any inversion of the sugar.

Mr. T. L. Patterson said in reply to Prof. Henderson that the experiments on the growth of the sugar beet were conducted in Scotland for four or five years, and were on the whole satisfactory. The roots grew well and yielded good crops, with a fair percentage of sugar, especially in the small and medium-sized roots. The yield of sugar per acre was high in some districts, higher even than Mr. McDonald had mentioned; whilst in other it was much below the average. The low yields were due more, perhaps, to inattention, or ignorance of the culture of the beet on the part of the grower, than to any climatic or other cause; hence such yields might be disregarded. But field experiments such as these were often misleading, and generally showed better results than could be obtained on the large scale. This was the case in the United States, and it would doubtless be the case here; therefore too much reliance should not be placed on the results. One fact brought out very clearly in Scotland was the large proportion which leaves bore to roots. This was evidently due to the cold, humid, sunless weather generally experienced in October and November, just when the roots should ripen and mature. Instead, they kept on growing so that even in December the roots were not ripe. The experiments on the whole went to show that it might be possible, notwithstanding somewhat unfavorable climatic conditions, to grow beets on the lowlands of Scotland for the manufacture of sugar. But until the bounties given to foreign producers by their governments, referred to by several speakers, were withdrawn, there was no probability of this being done at a profit.

In reply to Dr. Anderson, his own experiments showed that it required a low red heat to oxidize the carbon deposited in the char by the carbonization of the organic matter absorbed from the sugar, and he did not think a temperature of 400° F. would be sufficient to oxidize the organic matter alone. He had not referred to the lime process, as it was introduced prior to the period under review. The process has been long in use in one refinery. In reply to Mr. Playfair, the strontia process was not used in sugar refining. It was introduced by Scheibler in Germany for recovering sugar from molasses in the beet industry, but was now almost wholly superseded by Steffen's lime process. In this country there were no molasses to treat, and as the syrups went into consumption the sugar was not extracted from them. He had no experience of the electrolytic process of treating sugar solutions, nor was it used in this country. Electricity was on its trial on the Continent for treating beet root juice, and good results were said to have been obtained. Experiments just published, made on the large scale in a French factory, went to show that the purity of the juice was greatly improved by treating it with lime to alkalinity, and with powdered manganate of lime in small quantity, during the passage of an electric current of 7 to 10 volts. It was claimed that the sucrose in solution was not injured by the treatment, and that only the organic impurities were oxidized. But further experiments were required to confirm these statements, for it was well-known that sucrose was as easily oxidized as many of the organic impurities which accompanied it in the beet.

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GIFTS OF THE TROPICS.

Chief O. P. Austin of the Treasury Bureau of Statistics contributes to the June Forum an article on the growing importance of tropical imports, from which we abstract as follows:

Tropical products which earlier generations considered luxuries are now necessaries of life everywhere. The average consumption of sugar has risen from thirty-three pounds per capita in 1870 to sixty-eight pounds in 1901; coffee from six to nearly twelve pounds per capita; cocoa has increased six times; despite these gains of its rivals, consumption of tea is still as great; silks and satins are no longer luxuries; and rubber, a generation ago almost unknown, is now used everywhere.

The great railways have turned right angles and are facing towards the equator, bringing tropical products more into reach. The effect is readily observed in the temperate zones in greater comfort, more variety of food, better health and longer life.

This is especially the case in the United States, which now imports over $1,000,000 of tropical products every day. This is more than for most other countries, since most of our sugar comes from the tropics, the others depending on beet. Our recent consumption is near one-half the cane sugar and more than one-half the coffee of the world. In 1901 our imports of tropical goods were over $400,000,000, against $143,000,000 thirty years ago.

These figures fail to show the real growth because of the reduction in value per unit of quantity. The cost of sugar in the country exporting has since 1870 fallen from 5 to 2.3 cents; that of coffee from 12 to 18 cents to 7 cents; tea from 24 to 37 cents to 12.3 cents; raw silk from over $5 to a little more than $3 a pound.

There are four ways to measure this growth, all bringing identical results. The first is to consider imports by grand divisions. Imports from Asia, Africa, Oceanica and America south of the United States were in 1870, $157,000,000; 1875, $224,000,000; 1880, $265,000,000; 1890, $298,000,000; 1895, $310,-000,000; 1901, $414,000,000. Total imports meanwhile were: 1870, $436,000,000; 1875, $533,000,000; 1880, $668,000,000; 1890, $789,000,000; 1895, $740,000,000; 1901, $880,000,000. The share of tropical imports thus rose from 36 per cent in 1870 to 47 per cent in 1901. Further, the population of the United States has increased meanwhile from 38,000,0000 to 76,000,000, exactly doubling, while tropical imports increased from $167,000,000 to $414,000,000, or 165 per cent. Meanwhile non-tropical imports increased 55 per cent.

Taking tropical products by articles, we find that the most important are: Sugar, coffee, raw silk, Indian rubber, cocoa, fibres, fruits and nuts, tobacco, cotton and tea. In 1901 these aggregated $340,954,707, or 84 per cent of total tropical imports of $414,000,000. Since 1870, sugar rose from $70,000,000 to $114,000,000; coffee from $24,000,000 to $70,000,000; rubber, from $3,500,000 to $28,000,000; raw silk, from $3,000,000 to $40,000,000; fibres, from $6,000,000 to $25,000,000; fruits and nuts, from $7,500,000 to $20,000,000; cotton, from $500,000 to $8,500,000; tea has fallen from near $14,000,000 to $9,000,000.

The total value of all tropical imports was in 1870, $144,000,-000; 1875, $207,000,000; 1880, $246,000,000; 1890, $333,000,-000; 1895, $325,000,000; 1901, $405,000,000, corresponding closely to the figures by grand divisions.

A study by articles shows a great variation in increase measured by values. Sugar increased only 66 per cent in value, while population increased 100 per cent., yet consumption is twice as great as in 1870; coffee, however, increased nearly 200 per cent and cocoa over 1,000 per cent, tea decreased 33 per cent, though per capita the consumption was the same as in 1870.

Considering manufacturing articles, fibres and tobacco show nearly four times the value in 1870, rubber seven times, silk over twelve times, and cotton over twenty-five times, though the United States is now the greatest cotton-producing country.

It is only by quantities that one can realize the real growth, much more rapid than indicated by values. Since 1870 sugar increased from 1,196,000,000 to 4,569,000,000 pounds, about 300 per cent, against an increase in value of 66 per cent; coffee from 235,000,000 to 1,074,000,000 pounds, or over 300 per cent, against an increase in value of 200 per cent; silk from 500,000 to over 12,000,000 pounds; rubber from less than 10,000,000 to over 55,000,000 pounds; tobacco from 6,250,000 to nearly 29,000,000 pounds; cotton from less than 2,000,000 to over 68,000,000 pounds; dye goods from 43,533 tons to 255,771 tons; cocoa from less than 4,000,000 to over 50,000,000 pounds; tea decreased in value 33 per cent, but increased in quantity 50 per cent.

The largest increase is thus in materials for manufacturing. Foods increased 200 to 300 per cent, materials for manufacturing 300 to 3,000 per cent, while population was increasing 100 per cent.

In the fourth method of measurement we may make three groups—foods, raw material for manufacturing, and manufactures and luxuries. Foods show a growth in value of 10 per cent, which inclusion of Hawaii and Porto Rico for 1901 would raise to 25 per cent, manufactures and luxuries of 33 per cent, and manufacturers' materials of 90 per cent.

The chief growth in our imports is in tropical products, and there must be a growing demand for these, since we lack the necessary climate, while manufactures and luxuries our own producers will supply in increasing quantities.

In the light of these figures is it not possible we have builded better than we know in our recent unsought tropical acquisitions? The products of Hawaii have increased over twenty fold since the reciprocity treaty of 1876, and exports to the United States twenty-five times. Porto Rico shows over three times the average before the new relationship. Our exports to Hawaii have multiplied twenty times, and to Porto Rico five times. In 1901 the Philippines supplied over twice the total of 1899; their nearest neighbors, the Dutch Indies, supply us with more sugar than any other country save Cuba. With the Philippines twenty times as large as Hawaii and fifty times as populous, their possibilities are worthy of consideration.—American Cultivator.

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It is rumored that President Roosevelt has completed a treaty with Cuba, and that it will be submitted to the Senate in November. It is thought that the reduction in duties will be 33⅓ per cent.